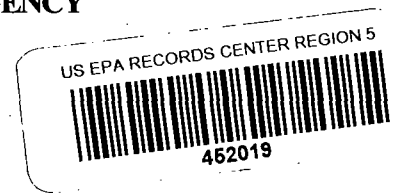


**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5**



DATE: March 24, 1998

SUBJECT: Ecological Assessment, Ray Holtman Farm, Quincy, IL

FROM: James Chapman, Ph.D., Ecologist, Remedial Response Section #1

TO: Ababi Harris, RPM, Remedial Response Section #2

This memo summarizes the ecological investigations at the Ray Holtman Farm site, Quincy, IL. My comments are based on Screening Site Inspection Final Report for Ray Holtman Farm, 3/19/93, prepared by B&V Waste Science and Technology Corp (referred to as SSI); and site visits and associated data on 9/5-6/95 (observe site), 11/27-29/95 (surface water and sediment sampling), and 10/28-29/97 (surface water sampling). Ecological work at this site has been confined to comparisons of surface water, sediment and soil analytical results with background and ecotoxicological screening values.

Soil

Surface soils were sampled in 1992 (SSI) in the land above the north creek. Analytes that exceed local background are listed in Table 1 with nonregulatory soil screening values. Selected inorganics for which risk-based soil screening values are unavailable are instead compared with background values established for the Eastern U.S. soils.

Table 1 shows that while several chemicals exceed local background values, none of the analytes exceed risk-based soil screening values. All but one of the inorganics for which risk-based soil screening values are unavailable occur on-site at concentrations less than the geometric mean + 1 deviation for the Eastern U.S.. The sole exception, iron, exceeds the geometric mean + 1 deviation, but is less than the geometric mean + 2 deviations.

Two VOCs, di-n-butylphthalate and bis(2-ethylhexyl)phthalate (BEHP), are elevated on-site, but there are no published soil screening values for assessing potential risk.

With the possible exceptions of di-n-butylphthalate and BEHP, the on-site soil contamination is unlikely to present a significant ecological risk. Although iron is elevated, the source is probably rusted cans in the landfill, and the levels do not exceed the range of background values determined for the Eastern U.S. soils (Shacklette and Boemgen 1984).

Sediment

Sediments were sampled in 1995 in the creeks north and south of the site (the south "creek" has its origin near the south dump site). Analytes that exceed local background are listed in Table 2 with nonregulatory sediment screening values. Selected inorganics for which risk-based sediment screening values are unavailable are instead compared with background values established for the Eastern U.S. soils and, in one case, for Illinois soils.

Chlordane, copper, sodium and zinc are elevated only in the south creek sediments. 1,1,1-trichloroethane is elevated only in the north creek sediments. Aluminum, calcium, magnesium, potassium and thallium are elevated in sediments of both creeks.

Table 2 shows that while several chemicals exceed local background values, none of the analytes exceed risk-based sediment screening values. The maximum copper result approaches (but does not exceed) the lowest effect level (LEL, defined as the level at which the most sensitive benthic invertebrate species may be affected, but the majority of benthic species are not adversely impacted), but is an order of magnitude below the severe effect level (SEL, the level expected to adversely affect the majority of benthic species). All but one of the inorganics for which risk-based soil screening values are unavailable occur on-site at concentrations less than the geometric mean + 1 deviation for the Eastern U.S.. The sole exception, calcium, exceeds the geometric mean + 1 deviation, but is less than the geometric mean + 2 deviations.

On-site sediment results for arsenic (12.4 ppm) exceed the sediment LEL (6 ppm), but are below the SEL (33 ppm). Arsenic results are not shown in Table 2 because the on-site concentrations are less than the background sample (21.2 ppm).

The on-site sediment contamination is unlikely to present a significant ecological risk.

Surface Water

Surface water samples were collected in 1995 from the north and south creeks, and in 1997 from the south creek. Analytes that exceed local background are listed in Table 3 with surface water screening values. Selected inorganics for which risk-based surface water screening values are unavailable are instead compared with maximum reported freshwater background concentration. Two analytes for which risk-based surface water screening values are unavailable (4-methylphenol and thallium) are evaluated against the minimum concentrations reported to result in adverse effects on aquatic receptors. Aluminum is evaluated by comparison with concentrations reported in acidified lakes.

1995 Results

In 1995, 4-methylphenol, aluminum, arsenic, barium, chromium, cobalt, copper, iron, magnesium, and nickel were elevated only in the south creek surface water. Thallium was elevated only in the north creek surface water. BEHP, potassium, vanadium and zinc were elevated in surface waters of both creeks.

The following analytes exceeded local background and ecotoxicological screening values in the 1995 samples: barium, chromium, cobalt, copper, iron, lead, and vanadium. In each case, the exceedance occurred only in the south creek sample. The screening values for copper and lead are hardness dependent, calculated for a default assumption of hardness equivalent to 100 mg/l as CaCO_3 (USEPA 1996). The surface waters at the site are very hard, with calculated hardness of 486 and 649 mg/l as CaCO_3 , for the north and south creeks, respectively (Table 3, footnote a). Lead and copper do not exceed site-specific screening values calculated for the maximum allowable hardness of 400 mg/l as CaCO_3 (USEPA 1996).

Magnesium and potassium exceeded both local background and maximum reported freshwater background concentrations in the south creek sample.

Aluminum exceeded the 1000 $\mu\text{g/l}$ level reported for acidified oligotrophic lakes (Sparling and Lowe 1996), again, only in the south creek sample. However, the toxicity of Al depends on pH, organic matter content, and other site-specific factors, so it is not known what concentrations would be associated with adverse effects in the south creek.

4-methylphenol is also elevated above local background in the south creek sample. There is no freshwater screening value for 4-methylphenol, but the detected concentration (11 $\mu\text{g/l}$) is well below the lowest toxicity values reported in AQUIRE (USEPA Aquatic Toxicity Information Retrieval, 3/18/98 search). The lowest lethal concentration (LC_{50}) is 7900 $\mu\text{g/l}$ reported for rainbow trout larvae (Degraeve, et al. 1980). Applying an uncertainty factor of 100 to convert the LC_{50} to a no effect concentration (NOEC) results in a value of 79 $\mu\text{g/l}$, nearly an order of magnitude above the maximum on-site concentration. Sublethal effects include decreased growth in fathead minnow larvae at 2570 $\mu\text{g/l}$ (Barron and Adelman 1984); a reproductive NOEC of 1000 $\mu\text{g/l}$ for *Daphnia* (water flea) (Kuhn, et al. 1989); and a decreased RNA/DNA ratio in fathead minnow larvae at 400 $\mu\text{g/l}$ (Barron and Adelman 1984). The sublethal effects occur at concentrations 1 to 2 orders of magnitude greater than the on-site concentration. 4-methylphenol is therefore not a contaminant of concern for ecological effects at the site.

Potentially adverse ecological effects can not be ruled out for the following inorganics in the south creek surface water: aluminum, barium, chromium, cobalt, iron, and vanadium. Magnesium and potassium are elevated above reported freshwater background levels, but with uncertain ecological effects.

1997 Results

The south creek surface water was resampled in 1997 to further evaluate the levels of inorganics. Both filtered and unfiltered surface water samples were analyzed (Table 3). The results show greatly decreased inorganic concentrations compared with 1995 results, even for unfiltered samples, with the sole exception of potassium. The reason for the divergent results are unclear. The 1995 samples were collected in late November, the 1997 samples in late October, so seasonal effects are unlikely. Water levels in the south creek, although not measured, did not appear noticeably different between the two sampling events.

The only analytes that exceed screening values in the unfiltered sample are barium and iron. Iron is primarily in a particulate form, as demonstrated by the order-of-magnitude decrease in concentration in the filtered sample, and therefore is mostly not bioavailable. Although barium greatly exceeds the screening value, the 1995 background concentration (336 $\mu\text{g/l}$) is more than twice as great as in the 1997 sample. There appears to be a local, perhaps natural, source of barium apart from the dump sites under investigation.

Again, magnesium and potassium exceeded reported freshwater background levels, however, both are essential nutrients of low toxicity. The elevated concentrations are not considered ecological risks.

The 1997 on-site surface water contamination is unlikely to present a significant ecological risk.

The main uncertainty is the unknown cause of the widely divergent results in 1995 and 1997 unfiltered samples.

Table 1. Surface Soil Ecological Screening Assessment, Ray Holtman Farm, Quincy, IL.

Chemical	Maximum Concentration	Low Screening Value		High Screening Value	
		Value	Ref.	Value	Ref.
		———— (mg/kg) ————		(mg/kg)	
Di-n-butylphthalate	0.28	n/a		n/a	
BEHP	0.2	n/a		n/a	
total DDT	0.0223	0.5	a		
Methoxychlor	0.0016	0.5	a		
Gamma chlordane	0.00043	0.5	a		
Aluminum	12,600	94,700	b		
Arsenic	18.4	30	a		
Barium	140	400	a		
Beryllium	0.52	1.4	b		
Calcium	3610	10,000	b		
Chromium	29.4	250	a		
Cobalt	11.5	50	a		
Copper	68.1	100	a		
Iron	71,500	40,000	b	115,000	c
Lead	122	150	a		
Magnesium	2370	7000	b		
Manganese	881	993	b		
Mercury	0.14	2	a		
Nickel	70.5	100	a		
Vanadium	39.7	108	b		
Zinc	46.6	500	a		

Table 1 References:

- a) Dutch/Quebec Soil Cleanup Criteria, Criteria B (moderate contamination that requires further study) (Beyer 1990).
 b) Eastern U.S. soil background, geometric mean + 1 geometric deviation (calculated from Shacklette and Boemgen 1984).
 c) Eastern U.S. soil background, geometric mean + 2 geometric deviations (calculated from Shacklette and Boemgen 1984).

Table 2. Sediment Ecological Screening Assessment, Ray Holtman Farm, Quincy, IL.					
Chemical	Maximum Concentration	Low Screening Value		High Screening Value	
		Value	Ref.	Value	Ref.
		———— (mg/kg) ————		(mg/kg)	
1,1,1-trichloroethane	0.001	0.17	a		
total Chlordane	0.0033	0.007	b		
Aluminum	6570	94,700	d		
Calcium	30,300	10,000	d	32,000	e
Copper	14.3	16	b	110	c
Magnesium	5320	7000	d		
Potassium	780	20,000	d		
Sodium	100	11,000	d		
Thallium	0.46	0.57	f		
Zinc	59	120	b		

- a) Ecotox Thresholds (USEPA 1996).
 b) Ontario sediment lowest effect level (LEL) (Persaud, et al. 1993).
 c) Ontario sediment severe effect level (SEL) (Persaud, et al. 1993).
 d) Eastern U.S. soil background, geometric mean + 1 geometric deviation (calculated from Shacklette and Boemgen 1984).
 e) Eastern U.S. soil background, geometric mean + 2 geometric deviations (calculated from Shacklette and Boemgen 1984).
 f) Illinois state-wide mean soil background (IEPA 1994).

Table 3. Surface Water Ecological Screening Assessment, Ray Holtman Farm, Quincy, IL.

Chemical	Maximum Concentration			Screening Value ^a		
	Unfiltered		Filtered	Hardness 100 mg/l	Ref	Hardness 400 mg/l
	1995	1997	1997			
	————— (μg/l) —————					(μg/l)
4-Methylphenol (p-cresol)	11			see text		
BEHP	23			32	b	
Aluminum	14,400	< 80	< 80	see text		
Arsenic	7.6	< 2	< 2	8.1 (As +5)	b	
Barium	495	121	111	3.9	b	
Chromium	15.7	< 10	< 10	10 (Cr +6)	b	
Cobalt	10.5	< 6	< 6	3	b	
Copper	15.1	< 6	< 6	11	b	39
Iron	44,800	3220	99.6	1000	b	
Lead	17.5	< 2	4	2.5	b	18.6
Magnesium	87,600	48,000	47,800	10,000	c	
Nickel	20.1	< 20	< 20	160	b	
Potassium	12,100	16,900	16,700	10,000	c	
Thallium	1	< 2	< 2	20	d	
Vanadium	33.2	< 5	< 5	19	b	
Zinc	77.1	< 40	< 40	100	b	

a) Screening values are hardness dependent for the following analytes: copper, lead, nickel and zinc. Screening is initially performed with a default assumption of hardness equivalent to 100 mg/l as CaCO₃ (USEPA 1996). Site-specific hardness values are 486 and 649 mg/l for the north and south creeks, respectively, calculated as $2.5 [Ca^{2+}] + 4.1 [Mg^{2+}]$, where Ca and Mg concentrations are given in ppm (Freeze and Cherry 1979). Site-specific screening values are calculated according to the procedures described in USEPA (1986) with the maximum allowable hardness of 400 mg/l (USEPA 1996).

b) Ecotox Thresholds (USEPA 1996)

c) Maximum reported freshwater background concentration (Vymazal 1995).

d) Minimum concentration reported to result in adverse effect on an aquatic receptor (USEPA 1986).

I may be contacted at 6-7195 if you have questions or comments. Please fill out the attached evaluation form and return it to Larry Schmitt, SR-6J. The information is used to assess and improve our services.

cc: Larry Schmitt, Section Chief, RRS #1

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